Letters to the Editor

The Board of Editors does not hold itself responsible for opinions expressed in the letter published in this section. The notes containing short reports of original investigations communicated to this section should not contain many figures and should not exceed 500 words in length. The contributions reaching the Secretary by the 15th of any month may be expected to appear in the issue for the next month. No proof will be sent to the author.

1

ANTIFERROMAGNETIC EXCHANGE IN HEMATITE

A. K. MUKERJEE

MAGNETISM DEPARTMENT

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE,

JADAVPUR, CALCUTTA-32. INDIA.

(*Received March 5, 1968*)

Accurate determination of exchange interactions in hematite, where a large number of direct and indirect interactions takes part, is extremely involved. Only the most important interaction giving rise to antiferromagnetism could be estimated tentatively from Neél temperature (T_N) and the field independent susceptibility at Neél temperature (χ_{T_N}) using Van Vleck's relations (1941).

Mukerjee (1967) has recently observed in fairly pure natural crystals of specular hematite (99.1% purity) that $T_N = 950°K$ and $\chi_{T_N} = 2956 \times 10^{-6}$ cgs emu/mol. (corrected for diamagnetism of $2Fe^{3+}$ and $3O^{2-}$). The nearest neighbours could be found following Osmond's suggestion (1962) that the most important antiferromagnetic interaction would be between the corner and the centre atoms, $M_1 - M_2$. Thus there are $6M_1$ corner atoms nearest to M_2 (the two along the body diagonal are to be excluded as they will lie in farther planes). The 'g' value may be assumed nearly 2 equal to 'g' found for Fe^{3+} in Al_2O_3 (Kornienko *et al*, 1958). Then

$$J(\text{from } T_N) = \frac{1}{2} \cdot \frac{T_N}{Z.S(S+1)} \text{ °K} \approx 27°K$$

$$J(\text{from } \chi_{T_N}) = \frac{Ng^2\beta^2}{4Zk(\chi_{T_N})} \text{ °K} \approx 21°K$$

where the notations have their usual meaning. Anderson's calculation (1959) yield a value of 30°K for $J(J_{eff} = 750°K$, therefore for $S = 5/2$, $J = 30°K)$.

In view of the simplifying assumptions made, the agreement is good. However, the result is also likely to have been affected by the impurities present in the natural crystal.

The author is thankful to Shri A. K. Dutta for guidance and Professor A. Bose for his kind interest in the work. He is also obliged to Dr. J. S. Smart for his opinion.

REFERENCES

Anderson, P. W., 1959, *Phys. Rev.*, **115**, 2.
Kornienko, L. S., and Prokhorov, A. M., 1958, *J.E.T.P.* **6**, 620.
Mukerjee, A. K., 1967, *Indian J. Phys*, **41**, 781.
Osmond, W. P., 1962, *Proc. Phys. Soc.*, **79**, 394.
Van Vleck, J. H., 1941, *Jour. Chem. Phys.*, **9**, 85.

2

A SEMI-CIRCULAR MAGNETIC SPECTROMETER WITH AIR-CORED COILS.

M. ANTONY

INSTITUT DE GEOLOGIE

UNIVERSITE DE STRASBOURG

STRASBOURG (FRANCE)

Conversion electrons furnish important details, concerning the multipolarity of the gamma-transitions, and enable us to establish nuclear disintegration schemes. The decays of excited nuclei, due to neutron deficiency, electron capture, or emission of β^+, are particularly favoured for the simultaneous analysis of the momenta of conversion electrons, because of the absence of the continuous β-spectrum. We describe below the construction of a semi-circular magnetic spectrometer, considered to be an excellent momentum analyser.

The magnetic field. The magnetic induction is provided by air cored bobbins of ellipsoidal geometry, having $\frac{\Delta B}{B} = 5.10^{-4}$ over a radius of 15 cm in the median plane (Antony, 1967). The importance of iron-free bobbins lies in the elimination of pronounced inhomogeneities, which are characteristic of fields employing iron, in the region of low magnetic induction. Thus, the spectrometer can be employed to study electrons of energies < 20 Kev. The excitation current is stabilised at 5.10^{-5}.